generation means for generating another transform coefficient in accordance with the operation of the entropy decoder means and the repetition means.

REMARKS

Claims 43-53, 55-69, 71-80, 91-95, 97-111, and 113-120 remain in this application. Claims 43, 44, 46-52, 55, 56, 58-60, 62-68, 71, 72, 74-76, 78-80, 91-94, 97-102, 104-110, and 113-120 have been amended to define still more clearly what Applicant regards as his invention, in terms which distinguish over the art of record. Claims 1-42, 54, 70, 81-90, 96, and 112 have been canceled without prejudice or disclaimer of subject matter. Claims 43, 51, 59, 67, 75, 93, 101, 109, and 117-120 are independent.

The Office Action states that Claims 17, 37, and 81-90 are not present in the application. By this Amendment, Applicant has officially canceled those claims.

Claims 66 and 92 were objected to because of certain informalities, namely that they depended from themselves. Applicant has corrected these claims accordingly, and withdrawal of the objection is respectfully requested.

Claims 1-16, 18-36, 38-80, and 91-120 were rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent 6,141,446 to Boliek et al.

First, cancellation of Claims 1-16, 18-36, 38-42, 54, 70, 96, and 112 renders the rejections of those claims moot.

Claim 43 is directed to a method of compressing data, the data comprising a plurality of transform coefficients. Each transform coefficient is expressible in a format including a plurality of bit symbols, the format comprising a number of leading zero bit symbols and retaining bit symbols. The method comprises the steps of (a) entropy

encoding a number representative of the number of leading zero bit symbols, not previously entropy coded, of a current transform coefficient based on a number of transform coefficients or part thereof surrounding the current transform coefficient; and (b) processing another transform coefficient, not previously entropy coded, in accordance with step (a).

Boelik et al., as understood by Applicant, relates to a system for encoding and decoding transform coefficients. (See the Abstract.) The system is adapted to perform wavelet style processing or binary style processing on image data or portions of image data. (See column 9, lines 50-54.) In the wavelet style processing, block 202 (see Fig. 2) performs a reversible wavelet transform, the output of block 202 being a series of coefficients. An embedded order quantization block 203 places the coefficients in bit-significance representation and then labels the coefficients in order to create an alignment of all of the coefficients in input image 201. (See column 9, lines 58-64.) Preferably, the wavelet style processing uses bit-plane coding. (See column 20, lines 51-62, and column 22, lines 36-44.) The binary style processing of the Boelik et al. system performs Gray coding followed by context-based bit-plane coding. (See column 9, lines 29-31.) With the binary style, each bitplane of the image tile is coded separately with each individual bit being conditioned and coded in raster order using the values of surrounding bits. (See column 10, lines 57-61.) The same binary entropy coder is used to code data from both the transform mode and the binary style. (See column 11, lines 4-6.)

Therefore, Boelik et al. encodes bit-plane by bit-plane of a block of coefficients. On the contrary, the method of Claim 43 encodes coefficient by coefficient. Moreover, nothing has been found in Boelik et al. that would teach or suggest entropy

encoding a number representative of the number of leading zero bit symbols of a current transform coefficient, as recited in Claim 43.

Accordingly, Applicant submits that Claim 43 is patentable over Boelik et al.

Independent Claims 59, 75, 101, 117, and 119 each include similar features to those discussed above in connection with Claim 43. Accordingly, these claims are believed to be patentable for substantially similar reasons to those discussed above in connection with Claim 43.

Claim 51 is directed to a method of compressing data. The data comprises a plurality of transform coefficients, and each transform coefficient is expressible in a format comprising a plurality of bit symbols. The method comprises the steps of: (a) entropy encoding one of the bit symbols, not previously entropy coded, of a current transform coefficient based on a number of surrounding bit symbols and on whether or not the most significant bit symbol of the current coefficient has been previously entropy coded; (b) repeating step (a) a predetermined number of times for the current transform coefficient; and (c) processing another transform coefficient, not previously entropy coded, in accordance with steps (a) and (b).

As explained above, Boelik et al. encodes bit-plane by bit-plane of a block of coefficients. On the contrary, the method of Claim 51 encodes coefficient by coefficient. Morever, nothing has been found in Boelik et al. that would teach or suggest entropy encoding one of the bit symbols, not previously entropy coded, of a current transform coefficient based on a number of surrounding bit symbols and on whether or not

the most significant bit symbol of the current coefficient has been previously entropy encoded, as recited in Claim 51.

Accordingly, Applicant submits that Claim 51 is patentable over Boelik et al.

Independent Claims 67, 93, 109, 118, and 120 each include similar features to those discussed above in connection with Claim 51. Accordingly, these claims are believed to be patentable for substantially similar reasons to those discussed above in connection with Claim 51.

A review of the other art of record has failed to reveal anything which, in Applicant's opinion, would remedy the deficiencies of the art discussed above, as references against the independent claims herein. Those claims are therefore believed patentable over the art of record.

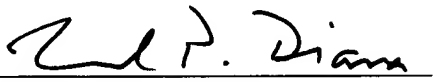
The other claims in this application are each dependent from one or another of the independent claims discussed above and are therefore believed patentable for the same reasons. Since each dependent claim is also deemed to define an additional aspect of the invention, however, the individual consideration or reconsideration, as the case may be, of the patentability of each on its own merits is respectfully requested.

An Information Disclosure Statement is in preparation and will be submitted shortly.

In view of the foregoing amendments and remarks, Applicant respectfully requests favorable reconsideration and early passage to issue of the present application.

Applicant's undersigned attorney may be reached in our New York office by telephone at (212) 218-2100. All correspondence should continue to be directed to our below listed address.

Respectfully submitted,



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VERSION MARKED TO SHOW CHANGES TO CLAIMS

1 - 42. (Canceled)

43. (Amended) A method of compressing data, wherein said data comprises a plurality of transform coefficients, and each transform coefficient is expressible in a format including a plurality of bit symbols, the format comprising a number of leading zero bit symbols and retaining bit symbols, the method [including] comprising the steps of:

[(a) applying a transform to the data to produce a plurality of transform coefficients, wherein each transform coefficient is expressible by a code representation including a plurality of symbols;]

[(b)] (a) entropy encoding [one of said symbols] a number representative of said number of leading zero bit symbols, not previously entropy coded, of a current transform coefficient based on [a context of] a number of [surrounding symbols] transform coefficients or part thereof surrounding said current transform coefficient; and

[(c) repeating step (b) a predetermined number of times for the current transform coefficient; and]

[(d)] (b) processing another transform coefficient, not previously entropy coded, in accordance with [steps (b) and (c)] step (a).

44. (Amended) A method as claimed in claim 43 wherein [said context of surrounding symbols is determined from previously encoded coefficients] the entropy encoding of the number representative of the number of leading zero bit symbols of a current transform coefficient is based on a context of a number of transform coefficients or part thereof surrounding the current transform coefficient.

46. (Amended) A method as claimed in claim 43, wherein [said predetermined number of times is consistent with an encoding of substantially all of the symbols of the current transform coefficient] said representative number equals the number of leading zero bit symbols.

47. (Amended) A method as claimed in claim [43] 44, wherein said context is determined from an arrangement of surrounding [symbols] transform coefficients.

48. (Amended) A method as claimed in claim 47, wherein said surrounding [symbols] transform coefficients are previously encoded [symbols] transform coefficients.

49. (Amended) A method as claimed in claim [48] 44, wherein said context [includes a first flag which indicates whether or not a most significant symbol of

the current transform coefficient has been encoded] is based on the number of non-zero transform coefficients surrounding said current transform coefficient.

50. (Amended) A method as claimed in claim [49] 43, wherein [said context includes a second flag which indicates whether or not a most significant symbol, of at least one transform coefficient spatially adjacent to the current transform coefficient, has been encoded] said method includes a further step of coding said remaining bit symbols.

51. (Amended) A method of compressing data, wherein said data comprises a plurality of transform coefficients, and each transform coefficient is expressible in a format comprising a plurality of bit symbols, [including] the method comprising the steps of:

[(a) applying a transform to the data to produce a plurality of transform coefficients, wherein each transform coefficient is expressible by a binary code representation having a plurality of bits;]

[(b)] (a) entropy encoding one of said [bits] bit symbols, not previously entropy coded, of a current transform coefficient based on a [context of] number of surrounding [bits] bit symbols and on whether or not the most significant bit symbol of the current coefficient has been previously entropy coded;

[(c)] (b) repeating step [b)] (a) a predetermined number of times for the current transform coefficient; and

[(d)] (c) processing another transform coefficient, not previously entropy coded, in accordance with steps [b) and c)] (a) and (b).

52. (Amended) A method as claimed in claim 51, wherein said [context of surrounding bats is determined from previously encoded coefficients] entropy encoding of one or more bit symbols of a current transform coefficient is based on a context of a number of surrounding bit symbols and on whether or not the most significant bit symbol of the current coefficient has been previously entropy coded.

54. (Canceled)

55. (Amended) A method as claimed in claim [51] 52, wherein said context of surrounding [bits] bit symbols includes information as to whether or not a most significant bit of at least one transform coefficient spatially adjacent, to the current transform coefficient, has been encoded.

56. (Amended) A method as claimed in claim 51, wherein said transform coefficients are represented in a bit-plane representation and said surrounding [bits] bit symbols are [bits] bit symbols in a current bit-plane.

58. (Amended) A method as claimed 43, wherein [said

transform is a Discrete Wavelet Transform] said method includes a further step of Discrete Wavelet Transforming data to produce said plurality of transform coefficients.

59. (Amended) A method of decompressing data, wherein said data once decompressed comprises a plurality of transform coefficients, and each transform coefficient is expressible in a format including a plurality of bit symbols, the format comprising a number of leading zero bit symbols and remaining bit symbols, the method [including] comprising the steps of:

(a) [entropying] entropy decoding [said data to generate a symbol of a current transform coefficient based on a context of surrounding symbols] an encoded number representative of said number of leading zero bit symbols of a current transform coefficient [based on a context of] a number of transform coefficients surrounding said current transform coefficient; and

[(b) repeating step (a) a predetermined number of times for the current transform;]

[(c)] (b) [generating] processing another transform coefficient in accordance with [steps (a) and (b)] step (a) [; and

(d) applying an inverse transform to the transform coefficients to produce data].

60. (Amended) A method as claimed in claim 59, wherein [said context of surrounding symbols is determined from previously encoded coefficients] the entropy decoding of the encoded number representative of the number of leading zero bit symbols of a current transform coefficient is based on a context of a number of transform coefficients or part thereof surrounding the current transform coefficient.

62. (Amended) A method as claimed in claim 59, wherein said [predetermined number of times is consistent with an decoding of substantially all of the symbols of the current transform coefficient] representative number equals the number of leading zero bit symbols.

63. (Amended) A method as claimed in claim [59] 60, wherein said context is determined from an arrangement of surrounding [symbols] transform coefficients.

64. (Amended) A method as claimed in claim 63, wherein said surrounding [symbols] transform coefficients are previously decoded [symbols] transform coefficients.

65. (Amended) A method as claimed in claim [64] 60, wherein said context [includes a first flag which indicates whether or not a most significant symbol of

the current transform coefficient is encoded or decoded] is based on the number of non-zero transform coefficients surrounding said current transform coefficient.

66. (Amended) A method as claimed in claim [66] 59, wherein [said context includes a second flag which indicates whether or not a most significant symbol, of at least one transform coefficient spatially adjacent to the current transform coefficient, is encoded or decoded] said method includes a further step of decoding encoded said remaining bit symbols.

67. (Amended) A method of decompressing data, wherein said data once decompressed comprises a plurality of transform coefficients, and each transform coefficient is expressible in a format comprising a plurality of bit symbols, the method [including the steps of] comprising:

(a) [entropying] entropy decoding [said data to generate a bit of a current transform coefficient] an encoded bit symbol of a current transform coefficient based on a [context of surrounding bits] number of surrounding bit symbols and on whether or not the most significant bit symbol of the current coefficient has been previously entropy decoded;

(b) repeating step [(b)] (a) a predetermined number of times for the current transform; and

(c) generating another transform coefficient in accordance with steps (a) and (b)

[(d) applying an inverse transform to the transform coefficients to produce data].

68. (Amended) A method as claimed in claim 67, wherein said [context of surrounding bits is determined from previously encoded coefficients] entropy decoding of one or more bit symbols of a current transform coefficient is based on a context of a number of surrounding bit symbols and on whether or not the most significant bit symbol of the current coefficient has been previously entropy coded.

70. (Canceled)

71. (Amended) A method as claimed in claim [67] 68, wherein said context of surrounding [bits] bit symbols includes information as to whether or not a most significant bit of at least one transform coefficient spatially adjacent, to the current transform coefficient, is encoded or decoded.

72. (Amended) A method as claimed in claim 67, wherein said transform coefficients are represented in a bit-plane representation and said surrounding [bits] bit symbols are [bits] bit symbols in a current bit-plane.

74. (Amended) A method as claimed in claim 59, wherein said [inverse transform is a inverse Discrete Wavelet Transform] method includes a further step for inverse Discrete Wavelet Transforming said transform coefficients.

75. (Amended) An apparatus for compressing data, wherein said data comprises a plurality of transform coefficients and each transform coefficient is expressible in a format including a plurality of bit symbols, the format comprising a number of leading zero bit symbols and remaining bit symbols, the apparatus including:

[transform means for applying a transform to the data to produce a plurality of transform coefficients, wherein each transform coefficient is expressible by a code representation including a plurality of symbols;]

entropy encoder means for entropy encoding [one of said symbols] a number representative of said number of leading zero bit symbols, not previously entropy coded, of a current transform coefficient based on [a context of surrounding symbols] a number of transform coefficients or part thereof surrounding said current transform coefficient; and

[repetition means for repeating the operations of the entropy encoder means a predetermined number of times for the current transform coefficient; and]

processor means for processing another transform coefficient, not previously entropy coded, in accordance with the operations of the entropy encoder means [and repetition means].

76. (Amended) An apparatus as claimed in claim 75, wherein [said context of surrounding symbols is determined from previously encoded coefficients] the entropy encoding of the number representative of the number of leading zero bit symbols of a current transform coefficient is based on a context of a number of transform coefficients or part thereof surrounding the current transform coefficient.

78. (Amended) An apparatus as claimed in claim 75, wherein [said predetermined number of times is consistent with an encoding of substantially all of the symbols of the current transform coefficient] said representative number equals the number of leading zero bit symbols.

79. (Amended) An apparatus as claimed in claim [75] 76, wherein said context is determined from an arrangement of surrounding [symbols] transform coefficients.

80. (Amended) An apparatus as claimed in claim 75, wherein said surrounding [symbols] transform coefficients are previously encoded [symbols] transform coefficients.

81 - 90. (Canceled)

91. (Amended) An apparatus as claimed in claim [80] 76, wherein said context [includes a first flag which indicates whether or not a most significant symbol of the current transform coefficient has been encoded] is based on the number of non-zero transform coefficients surrounding said current transform coefficient.

92. (Amended) An apparatus as claimed in claim [92] 75, wherein said [context includes a second flag which indicates whether or not a most significant symbol, of at least one transform coefficient spatially adjacent to the current transform coefficient, has been encoded] method includes a further step of coding said remaining bit symbols.

93. (Amended) An apparatus for compressing data, wherein the data comprises a plurality of transform coefficients, and each transform coefficient is expressible in a format comprising a plurality of bit symbols, the apparatus including:

[transform means for applying a transform to the data to produce a plurality of transform coeffieients, wherein each transform coefficient is expressible by a binary code representation having a plurality of bits;]

entropy encoder means for entropy encoding one of said [bits] bit symbols, not previously entropy coded, of a current transform coefficient based on a [context of] number of surrounding [bits] bit symbols and on whether or not the most significant bit symbol of the current coefficient has been previously entropy encoded;

repetition means for repeating the operation of the entropy encoder a predetermined number of times for the current transform coefficient; and

processor means for processing another transform coefficient in accordance with the operations of the entropy encoder means and repetition means.

94. (Amended) An apparatus as claimed in claim 93, wherein said [context of surrounding bits is determined from previously encoded coefficients] entropy encoding of one or more bit symbols of a current transform coefficient is based on a context of a number of surrounding bit symbols and on whether or not the most significant bit symbol of the current coefficient has been previously entropy coded.

96. (Canceled)

97. (Amended) An apparatus as claimed in claim [93] 94, wherein said context of surrounding [bits] bit symbols includes information as to whether or not a most significant bit of at least one transform coefficient spatially adjacent, to the current transform coefficient, has been encoded.

98. (Amended) An apparatus as claimed in claim 93, wherein said transform coefficients are represented in a bit-plane representation and said surrounding [bits] bit symbols are [bits] bit symbols in a current bit-plane.

99. (Amended) An apparatus as claimed in claim 75, wherein said entropy [encoding] encoder means is [performed by] an arithmetic coder.

100. (Amended) An apparatus as claimed in claim 75, wherein said [transform is a Discrete Wavelet Transform] apparatus further includes a transform means for Discrete Wavelet Transforming data to produce the plurality of transforming coefficients.

101. (Amended) An apparatus for decompressing data, wherein said data once decompressed comprises a plurality of transform coefficients and each transform coefficient is expressible in a format comprising a plurality of bit symbols, the format comprising a number of leading zero bit symbols and remaining bit symbols, the apparatus including:

entropy decoder means for entropying decoding [said data to generate a symbol of a current transform coefficient] an encoded number representative of said number of leading zero bit symbols of a current transform coefficient based on [a context of surrounding symbols] a number of transform coefficients or part thereof surrounding said current coefficient; and

[repetition means for repeating the operation of the entropy decoder means a predetermined number of times for the current transform coefficient;]

[generation] processor means for [generating] processing another transform coefficient in accordance with the operations of the entropy decoder means [and the repetition means; and

inverse transform means for applying an inverse transform to the transform coefficients to produce data].

102. (Amended) An apparatus as claimed in claim 101 wherein [said context of surrounding symbols is determined from previously decoded coefficients] the entropy decoding of the encoded number representative of the number of leading zero bit symbols of a current transform coefficient is based on a context of a number of transform coefficients or part thereof surrounding the current transform coefficient.

104. (Amended) An apparatus as claimed in claim 101, wherein [said predetermined number of times is consistent with a decoding of substantially all of the symbols of the current transform coefficient] said representative number equals the number of leading zero bit symbols.

105. (Amended) An apparatus as claimed in claim [101] 102, wherein said context is determined from an arrangement of surrounding [symbols] transform coefficients.

106. (Amended) An apparatus as claimed in claim 105, wherein said surrounding [symbols] transform coefficients are previously decoded [symbols] transform coefficients.

107. (Amended) An apparatus as claimed in claim [106] 105, wherein said context [includes a first flag which indicates whether or not a most significant symbol of the current transform coefficient is encoded or decoded] is based on the number of non-zero transform coefficients surrounding said current transform coefficient.

108. (Amended) An apparatus as claimed in claim [107] 101, wherein [said context includes a second flag which indicates whether or not a most significant symbol, of at least one transform coefficient spatially adjacent to the current transform coefficient, is encoded or encoded] said method includes a further step of decoding encoded said remaining bit symbols.

109. (Amended) An apparatus for decompressing data, wherein said data once decompressed comprises a plurality of transform coefficients, and each transform coefficient is expressible in a format comprising a plurality of bit symbols, the apparatus including:

entropy decoder means for [entropying] entropy decoding [said data to generate a bit of a current transform coefficient] an encoded bit symbol of a current

transform coefficient based on [a context of surrounding bits] a number of surrounding bit symbols and on whether or not the most significant bit symbol of the current coefficient has been previously entropy decoded;

repetition means for repeating the operation of the entropy decoder means a redetermined number of times for the current transform coefficient; and

generation means for generating another transform coefficient in accordance with the operation of the entropy decoder means and the repetition means [; and

inverse transform means for applying an inverse transform to the transform coefficients to produce data].

110. (Amended) An apparatus as claimed in claim 109, wherein [said context of surrounding bits is determined from previously decoded coefficients] the entropy decoding of one or more bit symbols of a current transform efficient is based on a context of a number of surrounding bit symbols and on whether or not the most significant bit symbol of the current coefficient has been previously entropy coded.

112. (Canceled)

113. (Amended) An apparatus as claimed in claim [109] 110, wherein said context of surrounding [bits] bit symbols includes information as whether or not a

most significant bit of at least one transform coefficient spatially adjacent, to the current transform coefficient, is encoded or decoded.

114. (Amended) An apparatus as claimed in claim 109, wherein said transform coefficients are represented in a bit-plane representation and said surrounding [bits] bit symbols are [bits] bit symbols in a current bit-plane.

115. (Amended) An apparatus as claimed in claim 101, wherein said entropy [decoding] decoder means is [performed by] an arithmetic coder.

116. (Amended) An apparatus as claimed in 101, wherein [said inverse transform is a inverse Discrete Wavelet Transform] said apparatus further includes an inverse transform means for inverse Discrete Wavelet Transforming the transform coefficients.

117. (Amended) A [computer program product including a] computer readable medium [having recorded thereon] comprising a computer program for compressing data, wherein said data comprises a plurality of transform coefficients, and each transform coefficient is expressible in a format including a plurality of bit symbols, the format comprising a number of leading zero bit symbols and remaining bit symbols, the computer program [product including] comprising:

[transform means for applying a transform, to the data to produce a plurality of transform coefficients, wherein each transform coefficient is expressible by a code representation including a plurality of symbols;]

entropy encoder means for entropy encoding [one of said symbols] a number representative of said number of leading zero bit symbols, not previously entropy coded, [or] of a current transform coefficient based on [a context of surrounding symbols] a number of transform coefficients or part thereof surrounding said current transform coefficient; and

[repetition means for repeating the operations of the entropy encoder means a predetermined number of times for the current transform coefficient; and]

processor means for processing another transform coefficient, not previously entropy coded, in accordance with the operations of the entropy encoder means [and repetition means].

118. (Amended) A [computer program product including a] computer readable medium [having recorded thereon] comprising a computer program for compressing data, wherein the data comprises a plurality of transform coefficients and each transform coefficient is expressible in a format comprising a plurality of bit symbols, the computer program [product including] comprising:

[transform means for applying a transform to the data to produce a plurality of transform coefficients, wherein each transform coefficient is expressible by a binary code representation having a plurality of bits;]

entropy encoder means for entropy encoding one of said [bits] bit symbols, not previously entropy coded, of a current transform coefficient based on a [context of] number of surrounding [bits] bit symbols and on whether or not the most significant bit symbol of the current coefficient has been previously entropy encoded;

repetition means for repeating the operation of the entropy encoder a predetermined number of times for the current transform coefficient; and

processor means for processing another transform coefficient in accordance with the operations of the entropy encoder means and repetition means.

119. (Amended) A [computer program product including a] computer readable medium [having recorded thereon] comprising a computer program for decompressing data, wherein said data once decompressed comprises a plurality of transform coefficients and each transform coefficient is expressible in a format comprising a plurality of bit symbols, the format comprising a number of leading zero bit symbols and remaining bit symbols, the computer program [product including] comprising:

entropy decoder means for [entropying] entropy decoding [said data to generate a symbol of a current transform coefficient based on a context of surrounding symbols] an encoded number representative of said number of leading zero bit symbols of

a current transform coefficient based on [a context of] a number of transform coefficients or part thereof surrounding said current coefficient; and

[repetition means for repeating the operation of the entropy decoder means a predetermined number of times for the current transform coefficient;]

[generation] processor means for [generating] processing another transform coefficient in accordance with the operations of the entropy decoder means [and the repetition means; and

inverse transform means for applying an inverse transform to the transform coefficients to produce data].

120. (Amended) A [computer program product including a] computer readable medium [having recorded thereon] comprising a computer program for decompressing data, wherein said data once decompressed comprises a plurality of transform coefficients, and each transform coefficient is expressible in a format comprising a plurality of bit symbols, the computer program [product including] comprising:

entropy decoder means for [entropying] entropy decoding [said data to generate a bit of a current transform coefficient] an encoded bit symbol of a current transform coefficient based on a [context of surrounding bits] number of surrounding bit symbols and on whether the most significant bit symbol of the current coefficient has been previously entropy decoded;

repetition means for repeating the operation of the entropy decoder means a predetermined number of times for the current transform coefficient; and

generation means for generating another transform coefficient in accordance with the operation of the entropy decoder means and the repetition means[; and

inverse transform means for applying an inverse transform to the transform coefficients to produce data].

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